MYCOTAXON
ISSN (print) 0093-4666 (online) 2154-8889 Mycotaxon, Ltd. ©2020

April–June 2020—Volume 135, pp. 339–344
https://doi.org/10.5248/135.339

Elaphomyces citrinus and *E. cyanosporus*, new for Turkey

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Abstract—The first records of two black *Elaphomyces*, *E. citrinus* and *E. cyanosporus*, are reported from Turkey. Short descriptions, photographs, and comments are provided.

Key words — biodiversity, *Elaphomycetaceae*, hypogeous ascomycetes, sequestrate, truffle-like fungi

Introduction

Elaphomyces T. Nees, "the deer fungus," is a sequestrate genus in *Elaphomycetaceae*. Its species are characterized by globose to subglobose or irregular hypogeous ascomata that have a fleshy to leathery and smooth to variously warty brown to dark blue or black peridium; a single chambered gleba comprising a powdery slate blue, purple-brown, dark brown, grey-black, or black spore mass; globose to subglobose 1–8-spored asci; and subglobose to globose spiny to verrucose spores (Trappe 1979, Castellano & al. 2012, Castellano & Stephens 2017).

Index Fungorum (2018) accepts 73 *Elaphomyces* taxa, of which four—*E. granulatus* Fr., *E. leucocarpus* Vittad., *E. muricatus* Fr., *E. septatus* Vittad.—have been reported from Turkey (Türkoğlu & al. 2015, Uzun & Kaya, 2019a,b). We report Turkish collections of two black *Elaphomyces* species, *E. citrinus* and *E. cyanosporus*. Current checklists (Sesli & Denchev 2014, Solak & al. 2015) and recent research papers (Işık & Türkekul 2017, Kaşık & al. 2017, Kaya 2015, Kaya & al. 2016, Kaya & Uzun 2018, Sesli 2018, Şelem & al. 2019; Türkekul 2017, Uzun & Kaya 2019c) have not yet reported *E. citrinus* and *E. cyanosporus* from Turkey. This study aims to contribute additional knowledge to the mycobiota of Turkey.

Materials & methods

The *Elaphomyces* fruit bodies were collected from Rize and Trabzon provinces during 2015–2018. The ascomata were photographed and the ecological data were recorded in the field; macroscopic and microscopic features were measured in the laboratory. The specimens were examined microscopically using a Nikon Eclipse Ci-S trinocular light microscope and Hitachi SU5000 scanning electron microscope and identified by consulting the literature (Pegler & al. 1993; Montecchi & Sarasini 2000; Arroyo & al. 2005; Binion & al. 2008; Saitta & al. 2009; Castellano & al. 2018; Hobart 2012; Paz & al. 2012, 2017). The specimens are preserved in the fungarium of Department of Biology, Science Faculty, Karamanoğlu Mehmetbey University, Karaman, Turkey (KMU).

Taxonomy

Elaphomyces citrinus Vittad. Monogr. Tuberac.: 65 (1831) FIG. 1

ASCOMA 10-40 mm in diameter, subglobose, usually covered with adherent lemon-yellow mycelium, not easily separating and binding soil particles to form a crust. CORTEX thin, composed of heavily carbonized dark brown hyphae. PERIDIUM 1–2 mm thick, with a thinner black outer cortex and a dark grey layer below, with a tissue of filamentous hyphae. GLEBA a grey-dark brown powder of thin-walled hyphae. ASCI globose, 8-spored. ASCOSPORES 10.5–12.5 µm in diameter, globose, dark brown when ripe, lightly aculeate-roughish, ornamented with fine anastomosed 0.5–1.5 µm high rods or ridges that form an irregular labyrinthine pattern.

SPECIMENS EXAMINED—TURKEY, TRABZON: **Tonya,** Hoşarlı village, 40°56′N 39°10′E, 1100 m, mixed forest, in soil under *Castanea sativa* Mill. and *Fagus orientalis* Lipsky, 17.09.2015, Y.Uzun 4537 (KMU); **Köprübaşı,** Yağmurlu village, 40°49′N 40°07′E, 420 m, mixed forest, under *Corylus avellana* L. and *F. orientalis,* 11.09.2017, Y.Uzun 5821 (KMU).

COMMENTS—In general, the macro- and micromorphological characteristics of our Turkish materials agree with *Elaphomyces citrinus* as described in the literature (Pegler & al. 1993, Saitta & al. 2009, Paz & al. 2012). The bright yellow mycelial crust is reported to be diagnostic of this species (Pegler & al. 1993, Montecchi & Sarasini 2000, Arroyo & al. 2005, Paz & al. 2017). *Elaphomyces cibulae* Castellano & al., also possesses a carbonized outer peridium and similar spore characters, but its white to ivory mycelial crust

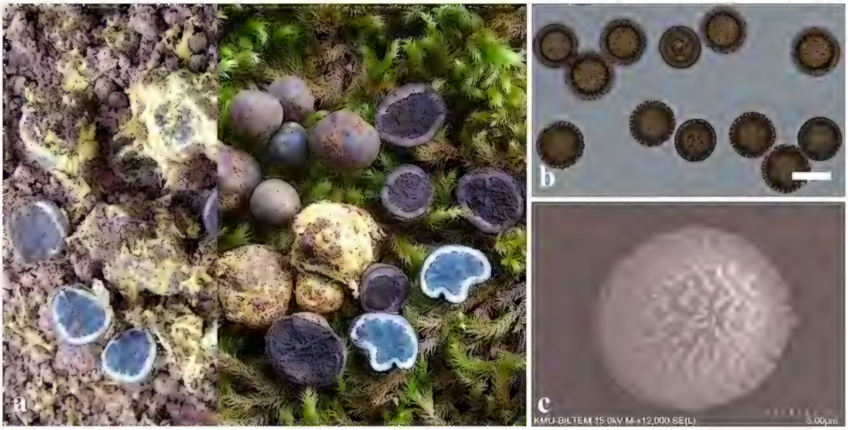

Fig 1. *Elaphomyces citrinus* (KMU, Uzun 4537).
a. Ascomata; b. Ascospores; c. SEM image of an ascospore. Scale bar: b = 10 µm.

and thicker peridial layer distinguish *E. cibulae* from *E. citrinus* (Castellano & al. 2018).

Elaphomyces cyanosporus Tul. & C. Tul, Fungi Hypog.: 113 (1851) Fig. 2

Ascoma 15–30 mm in diameter, globose to ovoid, dark brown to black, covered with blackish, thin, irregularly warty cortex. Peridium thick and double layered, the outer layer light brown with whitish and reddish tones, the darker inner layer almost equal in thickness with the outer layer. Gleba felty and grey when young, firm, turquoise to blackish blue at maturity. Asci globose 60–80 µm in diameter with thin hyaline walls. Ascospores 22–26 µm including ornamentation, globose, turquoise to black, ornamentation almost 2.5 µm high, forming a fine reticulum with coarse ridges.

Specimens examined—**TURKEY, Rize: Ardeşen,** Kirazlık village, 41°07′N 41°05′E, in soil under *Fagus orientalis* and *Rhododendron ponticum* L., 600 m, 08.08.2016, Y.Uzun 5207 (KMU); **Trabzon: Sürmene,** Ormanseven village, 40°50′N 40°09′E, in soil under *F. orientalis* and *Carpinus betulus* L., 695 m, 07.07.2018, Y.Uzun 6660 (KMU); **Yomra,** İkisu village, 40°55′N 39°47′E, in soil under *F. orientalis* and *R. ponticum*, 280 m, 08.07.2018, Y.Uzun 6667 (KMU); **Beşikdüzü,** Oğuz village, 41°01′N 39°09′E, in soil under *Castanea sativa* and *R. ponticum*, 740 m, 26.08.2018, Y.Uzun 6687 (KMU).

Comments—*Elaphomyces cyanosporus* is a distinctive species with its blue-green tinged inner peridium and spores (Montecchi & Sarasini 2000, Binion & al. 2008, Hobart 2012). It is one of the reticulate-spored members of the genus

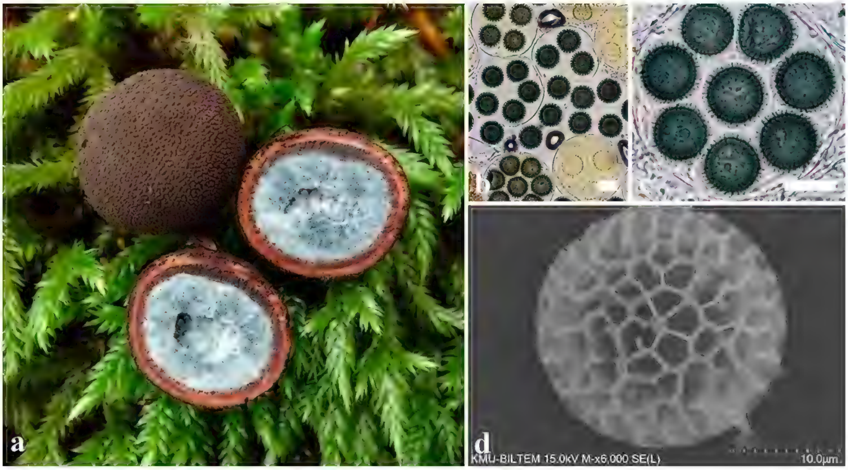

Fig 2. *Elaphomyces cyanosporus* (KMU, Uzun 6667).
a. Ascomata; b, c. Asci and ascospores; d. SEM image of an ascospore.
Scale bars: b, c = 20 µm.

(Zhang 1991, Castellano & al. 2016), and the reticulate spore ornamentation of our samples fits well with Castellano & al. (2018). *Elaphomyces persoonii* Vittad., which also has a black warty peridium and similar reticulate spore ornamentation, differs from *E. cyanosporus* by its taller alveoli walls and larger spores (Castellano & al. 2018).

Acknowledgments

The authors would like to thank Karamanoğlu Mehmetbey University Research Fund (02-M-15 and 16–M–16) for its financial support, Doğancan Kuduban and Yücel Uzun for their kind help in field, and Dr. Vladimír Antonín (Moravian Museum, Brno, Czechia), Prof. Dr. Ertuğrul Sesli (Trabzon University, Turkey), and Dr. Shaun Pennycook (Manaaki Whenua Landcare Research, Auckland) for their helpful comments and careful review.

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